NOTES ON DIPTEROUS PARASITES OF SPIDERS

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In the course of some studies carried on at the Osborn Zoological Laboratory, Yale University, I had the opportunity to note a few cases of parasitism of spiders by insects. By far the greater proportion of these parasites are Hymenoptera; a few are Diptera. Diptera bred from egg cocoons have been reported by Coquillet (1892, 1898), Davidson (1894), C. Koch (according to König, 1894), Brues (1902, 1903), Auten (1925), Kintner (1935), and Herms *et al.* (1935). Internal parasites of spiders themselves have been Diptera of the family Cyrtidæ.[1] The members of this family are admittedly uncommon in entomological collections, and naturally specimens are more apt to be reared by collectors of spiders than of Diptera. The first specimen reared was an *Ogcodes pallipes* Erichson from *Clubiona putris* Koch by Menge (1866). Brauer (1869) reared *Astomella lindenii* Er. from *Cteniza ariana* Koch. Emerton (1890) obtained a specimen that proved to be *Acrocera fasciata* Wiedemann from *Amaurobius bennetti* Blackwall. The same species was reared by Montgomery (1903) from *Schizocosa crassipes* (Walckenaer). *Ogcodes doddi* Wandolleck was bred from *Cosmophasis bitaeniata* Keyserling (Wandolleck, 1906). King (1916) gave a very complete account of the life history, and description of all the stages of *Pterodontia flavipes* Gray. The hosts are *Araneus sericatus* Clerck and *Lycosa pratensis* Emerton. Nielsen (1932) reared *Acrocera globulus* Panzer from a *Lycosa* sp., and *Ogcodes gibbosus* Linn. from *Prosthesima* sp.

Johnson (1903) in discussing Montgomery's rearings suggested that "many spiders, perhaps 25 per cent., are thus parasitized." However, it is my opinion that Montgomery's case was unusual. Even spiders bearing hymenopterous larvæ, which are ectopara-

[1] McCook (1890) refers to a *hymenopterous* larva emerging from the body of a spider, but this is probably an error. The specimen was not reared.

sitic and hence easily seen, are seldom encountered in nature. This was pointed out by the distinguished Danish araneologist, Nielsen, who has investigated the life histories of many hymenopterous parasites, yet has reared but two cyrtids. Of the close to a thousand spiders I have kept alive in the laboratory for considerable periods of time during the last four years I found only five so parasitized.

According to Johnson (1915), Montgomery was able to detect those spiders which were parasitized long before the emergence from the host. On the contrary, the spiders I had gave no indications of being parasitized even up to within a day or so of the parasites' emergence, though they were being closely observed almost daily in various experiments. Hence the parasite must grow at a tremendous rate during the last few hours of the host's life.

I am indebted to Dr. C. H. Curran of the American Museum of Natural History for his kindness in determining the flies, and to my wife for the illustrations.

Ogcodes costatus Loew.

The host spider was an immature *Lycosa* sp. collected at Orange, Conn., May 9, 1935. It was killed May 22 by the emergence of the parasite larva which had cut its way out through the ventral side of the abdomen near the anterior end (Fig. 1). The cephalothorax and coxæ were eaten out as well as the abdomen, but only the latter was shrivelled. The fully developed larva (Fig. 2) is markedly different in appearance from the corresponding stages figured by Brauer for *Astomella,* by Emerton for *Acrocera,* by King for *Pterodontia,* and by Nielsen for *Acrocera.* It agrees somewhat with the brief descriptions of *Ogcodes pallipes,* and of *O. gibbosus* as given by Menge and Nielsen, respectively. The young stages of cyrtid larvæ have been described by Maskell (1888), König, and King. They differ both in structure and method of movement from the fully developed stages.

The larva was 9.35 mm. long and had a glistening sticky skin which caused particles of debris to adhere to it. There was a small inconspicuous head, light yellow in color. Of the mouth-

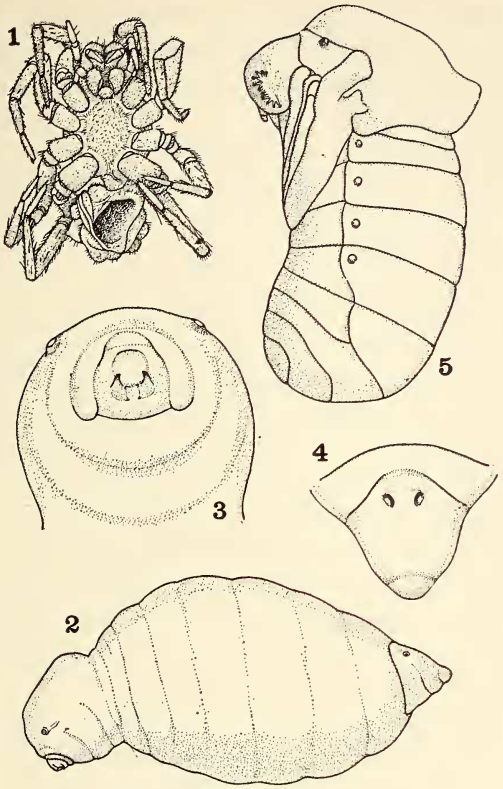

Figure 1. Ventral aspect of *Lycosa* sp. killed by the emergence of *Ogcodes costatus* larva.
Figure 2. Left lateral aspect of *O. costatus* larva after emergence from host.
Figure 3. Ventral aspect of anterior end of larva.
Figure 4. Dorsal aspect of posterior end of larva.
Figure 5. Left lateral aspect of pupa.

parts (Fig. 3) only a pair of darkly pigmented mandibular or oral hooks could be discerned. There was a distinct globular yellowish thorax. Faint indications of its subdivisions were present on the ventral side, and a pair of darkly pigmented spiracles were borne near the dorsal surface of the prothorax. The tracheæ connecting with these were visible for some distance beneath the skin. The abdomen was large, creamy white, and divided into what

appeared to be seven indistinct precaudal segments and a distinct conical upwardly sloping caudal segment. The latter was itself partly divided by two ventral folds, and bore a pair of spiracles on its dorsal surface (Fig. 4).

On May 23 it pupated. The excrements voided before pupation remained as a long, thin, black, curved string extending from the caudal end of the pupa. Malloch (1915) described the pupa of this species and figured the abdomen. Unfortunately his material was very poorly preserved so that the description is not entirely applicable here. The total length was about 6.25 mm., measured from the disc of the prothorax, as the head was bent down considerably on the ventral side of the thorax (Fig. 5). On either side of the head were two sextets of papilliform processes which were pigmented at the tips. In this and in having the posterior three segments (6 to 8) of the abdomen slightly telescoped into the preceding, it resembled *Pterodontia* as described and figured by King. Malloch described the head as being "without discoverable protuberances or hairs," and figured the last segment of the abdomen protuberant. There were a pair of prothoracic spiracles, and a pair on each of the first four abdominal segments, all elevated from the general body surface.

On May 28 the pupa had become quite dark and looked ready to emerge within a day or so. There was very little change in appearance on the succeeding days and on June 1 it was dead. The probable duration of the pupal period is 6 to 7 days.

Ogcodes pallidipennis Loew.

According to Cole (1919) an individual of this species in the U. S. National Museum collected by A. A. Girault at Coulterville, Ill., has a label "Bred from cell of *Sceliphron cementarius*. Iss. June 18, 1919." This mud-daubing wasp provisions its nest with very many species of spiders so that the particular host of the parasite cannot be ascertained. In the collection of the Connecticut Agricultural Experiment Station there are two specimens. One label reads "New Haven, Ct., 13 July 1904, P. L. Butrick"; the other, "Pine Orchard [in Branford] Ct., 26 July 1904, H. L. Vierick."

My observations on this species were unfortunately not as detailed as for *O. costatus,* due to press of other matters, nor were any drawings made. However, I can recall that the larva closely resembles that of *costatus.* I have no recollections concerning the pupa. In all four cases which I observed, the parasite left the host through the latter's abdomen, after cleaning out the cephalothorax and coxæ as described for *costatus.*

From an immature *Pardosa banksi* Chamberlin collected at Indian Neck in Branford, Conn., May 17, 1932, the parasite emerged July 1. It was not reared. From a similar specimen collected with the first, the parasite emerged July 16, pupated July 17, and the imago emerged July 22. From a mature female of the same species collected in the same locality June 7, 1933, the parasite emerged July 7, pupated July 8, and the imago emerged July 14. From an immature *Pardosa saxatilis* (Hentz) collected at New Haven, Conn., May 18, 1934, the parasite emerged June 14, pupated June 15, and the imago emerged June 20. This indicates the duration of the pupal period to be 5 to 6 days. All the imagines were very sluggish, not flying at all, and walking about only when poked.

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Note. Some time after this manuscript left my hands for the editors I happened upon a note by A. Giard (1894, Sur quelques parasites des araignées, Bull. Soc. Ent. France, pp. CLIII–CLV). This author collected a specimen of *Ogcodes pallipes* standing near the pupal skin from which it had recently emerged. Nearby were the remains of a *Clubiona* sp., its host. Mr. K. C. McKeown of the Australian Museum has recently written me that "there are records of unnamed Cyrtidæ attacking several species of spiders" in Australia.